10/614808
07/09/03

US006470432B2

(12) **United States Patent**

Ozawa et al.

(10) Patent No.: **US 6,470,432 B2**
(45) Date of Patent: ***Oct. 22, 2002**

(54) **EXTERNAL STORAGE CONTROL DEVICE AND DATA TRANSFER METHOD BETWEEN EXTERNAL STORAGE CONTROL DEVICES**

(75) Inventors: **Koji Ozawa; Kazuhide Sano; Takeshi Koide; Katsunori Nakamura**, all of Odawara (JP)

(73) Assignee: **Hitachi, Ltd.**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,990,055 A	11/1976	Henderson et al.
4,451,884 A	5/1984	Heath et al.
5,155,845 A	10/1992	Beal et al.
5,235,690 A	8/1993	Beardsley et al.
5,247,665 A	9/1993	Matsuda et al.
5,572,699 A	11/1996	Kamo et al.
5,588,012 A	12/1996	Oizumi
5,613,155 A	3/1997	Baldiga et al.
5,625,840 A	4/1997	Numata et al.
5,644,787 A	7/1997	Nakamura et al.
5,740,465 A	4/1998	Matsunami et al.
5,901,327 A	5/1999	Ofek
5,940,865 A	8/1999	Ohzora et al.
5,996,045 A	11/1999	Lee et al.
6,003,114 A	12/1999	Bachmat

Primary Examiner—David Hudspeth
Assistant Examiner—Fred F. Tzeng
(74) *Attorney, Agent, or Firm*—Mattingly, Stanger & Malur, P.C.

(57) **ABSTRACT**

In a data processing system in which main and sub disk storage devices are under the control of individual each disk control devices, the write processing time is reduced by selectively sending data according to the command-chaining time between main and sub disk control devices. A section for judging cable length and function of the sub disk control device 36 estimates command-chaining time between a pair of main and sub disk storage devices. The channel command analyzing section 31 estimates the number of records to be transferred and the length of a record using a LOCATE RECORD command. The command judgment section for the sub disk control device 32 optimizes the command-chain to be issued to the sub disk control device using the above-mentioned information. Then, the section for issuing command to the sub disk control device 35 issues the optimized command chain. Thus, a shorter transmission time is realized by either sending individual records or an entire track of data.

11 Claims, 6 Drawing Sheets